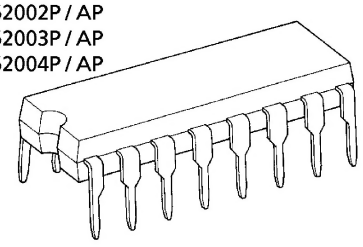
TOSHIBA BIPOLAR DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

TD62001P, TD62001AP, TD62001F, TD62001AF, TD62002P, TD62002AP, TD62002F TD62002AF, TD62003P, TD62003AP, TD62003F, TD62003AF, TD62004P, TD62004AP TD62004F, TD62004AF

7CH DARLINGTON SINK DRIVER

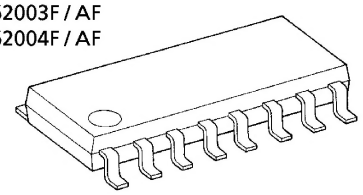
The TD62001P / AP / F / AF Series are high-voltage, high-current darlington drivers comprised of seven NPN darlington pairs.
All units feature integral clamp diodes for switching inductive loads.
Applications include relay, hammer, lamp and display (LED) drivers.

TD62001P / AP
TD62002P / AP
TD62003P / AP
TD62004P / AP



DIP16-P-300-2.54A

TD62001F / AF
TD62002F / AF
TD62003F / AF
TD62004F / AF



SOP16-P-225-1.27

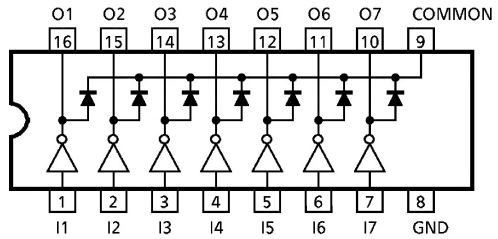
Weight
DIP16-P-300-2.54A : 1.11g (Typ.)
SOP16-P-225-1.27 : 0.16g (Typ.)

FEATURES

- Output current (single output) 500mA MAX.
- High sustaining voltage output
  35V MIN. (TD62001P / F Series)
  50V MIN. (TD62001AP / AF Series)
- Output clamp diodes
- Inputs compatible with various types of logic
- Package Type-P, AP : DIP-16pin
- Package Type-F, AF : SOP-16pin

TYPE	INPUT BASE RESISTOR	DESIGNATION
TD62001P / AP / F / AF	External	General Purpose
TD62002P / AP / F / AF	10.5-kΩ + 7V Zenner diode	14~25V PMOS
TD62003P / AP / F / AF	2.7kΩ	TTL, 5V CMOS
TD62004P / AP / F / AF	10.5kΩ	6~15V PMOS, CMOS

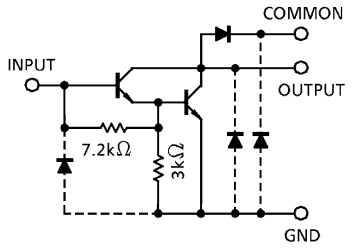
PIN CONNECTION (TOP VIEW)



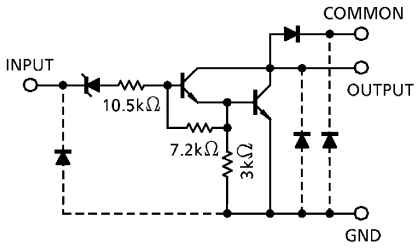
961001EBA2

SCHEMATICS (EACH DRIVER)

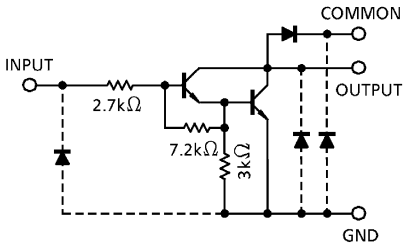
TD62001P / AP / F / AF



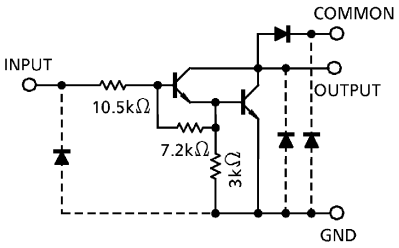
TD62002P / AP / F / AF



TD62003P / AP / F / AF



TD62004P / AP / F / AF



(Note) The input and output parasitic diodes cannot be used as clamp diodes.

MAXIMUM RATINGS (Ta = 25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Output Sustaining Voltage	P, F	$V_{CE\ (SUS)}$	−0.5~35	V
	AP, AF		−0.5~50	
Output Current		I_{OUT}	500	mA / ch
Input Voltage		V_{IN} (Note 1)	−0.5~30	V
Input Current		I_{IN} (Note 2)	25	mA
Clamp Diode Reverse Voltage	P, F	V_R	35	V
	AP, AF		50	
Clamp Diode Forward Current		I_F	500	mA
Power Dissipation	P	P_D	1.0	W
	AP		1.47	
	F, AF		0.54 / 0.625 (Note 3)	
Operating Temperature	P	T_{opr}	−30~75	°C
	AP, F, AF		−40~85	
Storage Temperature		T_{stg}	−55~150	°C

(Note 1) Except TD62001P / AP / F / AF
(Note 2) Only TD62001P / AP / F / AF
(Note 3) On glass epoxy PCB (30 × 30 × 1.6mm Cu 50%)

RECOMMENDED OPERATING CONDITIONS (Ta = −40~85°C and Ta = −30~75°C for only Type-P)

CHARACTERISTIC		SYMBOL	CONDITION		MIN.	TYP.	MAX.	UNIT
Output Sustaining Voltage	P, F	$V_{CE\ (SUS)}$			0	—	35	V
	AP, AF				0	—	50	
Output Current	AP	I_{OUT}	T_{pw} = 25ms, 7 Circuits, Ta = 85°C, T_j = 120°C	Duty = 10%	0	—	370	mA / ch
				Duty = 50%	0	—	130	
	P			Duty = 10%	0	—	295	
				Duty = 50%	0	—	95	
	F, AF			Duty = 10%	0	—	233	
				Duty = 50%	0	—	70	
Input Voltage	Except TD62001P / AP / F / AF	V_{IN}			0	—	24	V
Input Voltage (Output On)	TD62002	$V_{IN\ (ON)}$	I_{OUT} = 400mA, h_{FE} = 800		14.5	—	24	V
	TD62003				2.8	—	24	
	TD62004				6.2	—	24	
Input Voltage (Output Off)	TD62001	$V_{IN\ (OFF)}$			0	—	0.6	V
	TD62002				0	—	7.4	
	TD62003				0	—	0.7	
	TD62004				0	—	1.0	
Input Current	Only TD62001	I_{IN}			0	—	10	mA
Clamp Diode Reverse Voltage	P, F	V_R			—	—	35	V
	AP, AF				—	—	50	
Clamp Diode Forward Current		I_F			—	—	350	mA
Power Dissipation	P	P_D	Ta = 85°C		—	—	0.6	W
	AP				—	—	0.76	
	AF, F		(Note) Ta = 85°C		—	—	0.325	

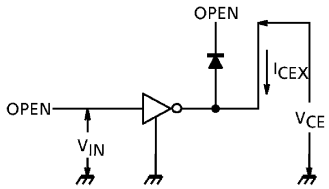
(Note) On glass epoxy PCB (30 × 30 × 1.6mm Cu 50%)

ELECTRICAL CHARACTERISTICS (Ta = 25°C unless otherwise noted)

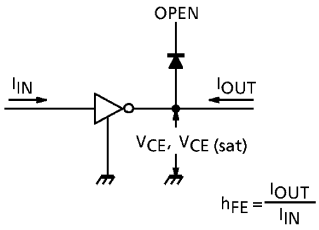
CHARACTERISTIC		SYMBOL	TEST CIR-CUIT	TEST CONDITION		MIN.	TYP.	MAX.	UNIT
Output Leakage Current	AP, AF	I_{CEX}	1	V_{CE} = 50V, Ta = 25°C		—	—	50	μA
				V_{CE} = 50V, Ta = 85°C		—	—	100	
	F			V_{CE} = 35V, Ta = 25°C		—	—	50	
				V_{CE} = 35V, Ta = 85°C		—	—	100	
	P			V_{CE} = 35V, Ta = 25°C		—	—	50	
				V_{CE} = 35V, Ta = 75°C		—	—	100	
Collector-Emitter Saturation Voltage		$V_{CE\ (sat)}$	2	I_{OUT} = 350mA, I_{IN} = 500μA		—	1.3	1.6	V
				I_{OUT} = 200mA, I_{IN} = 350μA		—	1.1	1.3	
				I_{OUT} = 100mA, I_{IN} = 250μA		—	0.9	1.1	
DC Current Transfer Ratio		h_{FE}	2	V_{CE} = 2V, I_{OUT} = 350mA		1000	—	—	
Input Current (Output On)	TD62002	$I_{IN\ (ON)}$	3	V_{IN} = 20V, I_{OUT} = 350mA		—	1.1	1.7	mA
	TD62003			V_{IN} = 2.4V, I_{OUT} = 350mA		—	0.4	0.7	
	TD62004			V_{IN} = 9.5V, I_{OUT} = 350mA		—	0.8	1.2	
Input Current (Output Off)	P	$I_{IN\ (OFF)}$	4	I_{OUT} = 500μA, Ta = 75°C		50	65	—	μA
	AP, F, AF			I_{OUT} = 500μA, Ta = 85°C		50	65	—	
Input Voltage (Output On)	TD62002	$V_{IN\ (ON)}$	5	V_{CE} = 2V, h_{FE} = 800	I_{OUT} = 350mA	—	—	13.7	V
					I_{OUT} = 200mA	—	—	11.4	
	TD62003				I_{OUT} = 350mA	—	—	2.6	
					I_{OUT} = 200mA	—	—	2.0	
	TD62004				I_{OUT} = 350mA	—	—	4.7	
					I_{OUT} = 200mA	—	—	4.4	
Clamp Diode Reverse Current	AP, AF	I_R	6	V_R = 50V, Ta = 25°C		—	—	50	μA
				V_R = 50V, Ta = 85°C		—	—	100	
	F			V_R = 35V, Ta = 25°C		—	—	50	
				V_R = 35V, Ta = 85°C		—	—	100	
	P			V_R = 35V, Ta = 25°C		—	—	50	
				V_R = 35V, Ta = 75°C		—	—	100	
Clamp Diode Forward Voltage		V_F	7	I_F = 350mA		—	—	2.0	V
Input Capacitance		C_{IN}	—			—	15	—	pF
Turn-On Delay	P, F	t_{ON}	8	V_{OUT} = 35V, R_L = 87.5Ω, C_L = 15pF		—	0.1	—	μs
	AP, AF			V_{OUT} = 50V, R_L = 125Ω, C_L = 15pF		—	0.1	—	
Turn-Off Delay	P, F	t_{OFF}	8	V_{OUT} = 35V, R_L = 87.5Ω, C_L = 15pF		—	0.2	—	
	AP, AF			V_{OUT} = 50V, R_L = 125Ω, C_L = 15pF		—	0.2	—	

TEST CIRCUIT

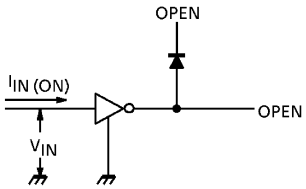
1. I_{CEX}



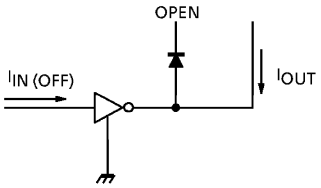
2. $V_{CE\ (sat)}$, h_{FE}



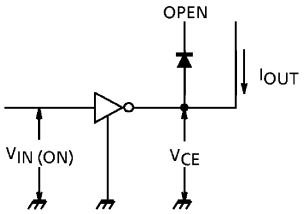
3. $I_{IN\ (ON)}$



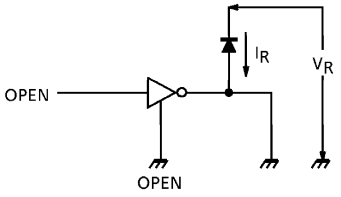
4. $I_{IN\ (OFF)}$



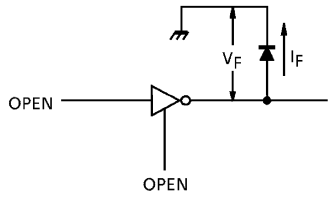
5. $V_{IN\ (ON)}$



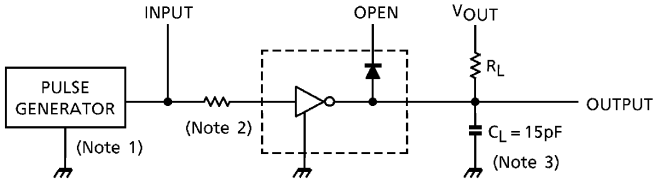
6. I_R

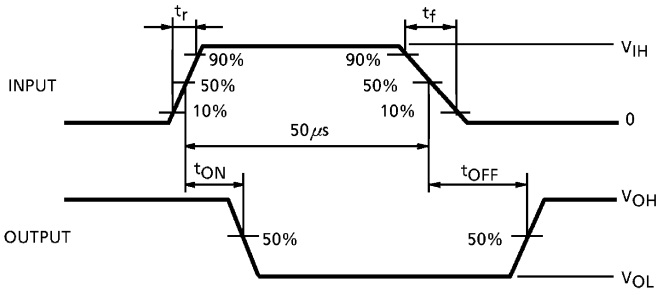


7. V_F



8. t_{ON}, t_{OFF}





(Note 1) Pulse width 50μs, duty cycle 10%
Output impedance 50Ω, $t_r \leqq$ 5ns, $t_f \leqq$ 10ns

(Note 2) See below

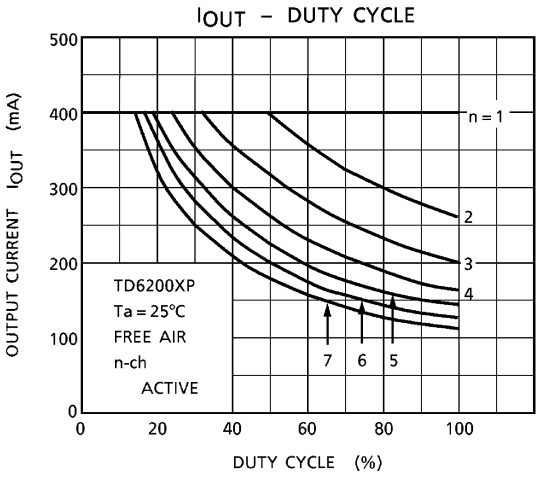
INPUT CONDITION

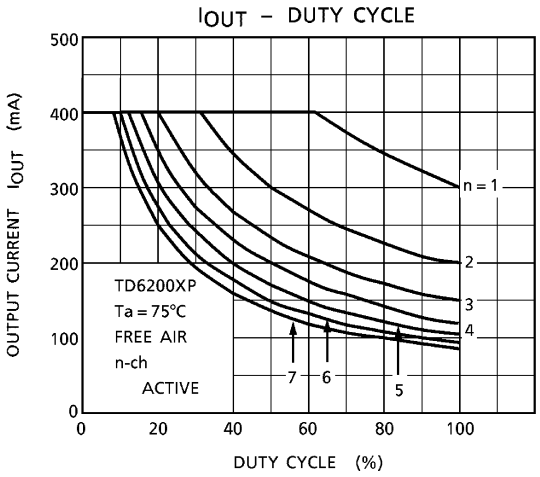
TYPE NUMBER	R1	V_{IH}
TD62001P / AP / F / AF	2.7kΩ	3V
TD62002P / AP / F / AF	0	13V
TD62003P / AP / F / AF	0	3V
TD62004P / AP / F / AF	0	8V

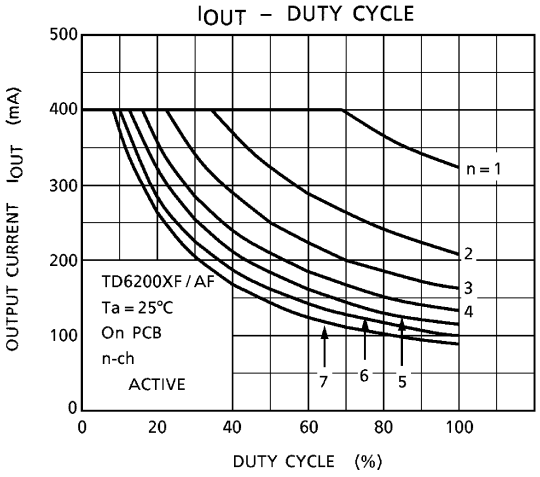
(Note 3) C_L includes probe and jig capacitance.

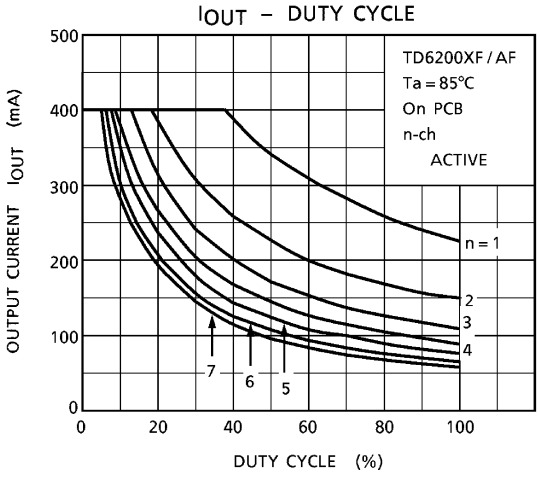
PRECAUTIONS for USING

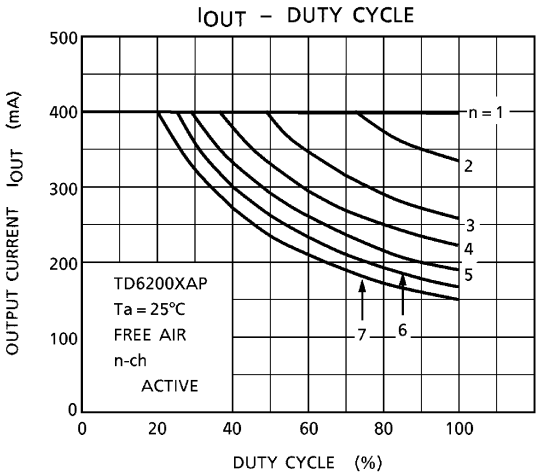
Utmost care is necessary in the design of the output line, COMMON and GND line since IC may be destroyed due to short-circuit between outputs, air contamination fault, or fault by improper grounding.

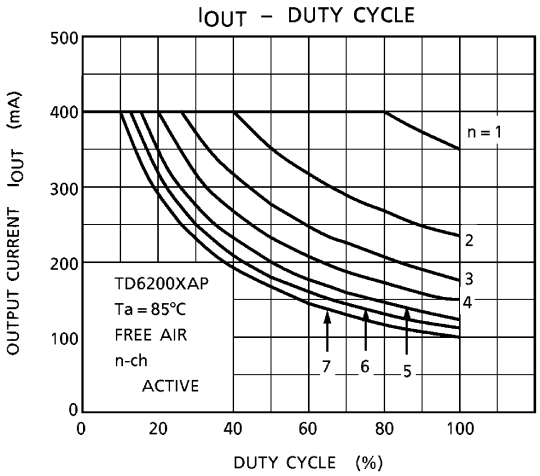

I_{OUT} – DUTY CYCLE
OUTPUT CURRENT I_{OUT} (mA)
DUTY CYCLE (%)
TD6200XP
Ta = 25°C
FREE AIR
n-ch
ACTIVE
n = 1
2
3
4
7
6
5


I_{OUT} – DUTY CYCLE
OUTPUT CURRENT I_{OUT} (mA)
DUTY CYCLE (%)
TD6200XP
Ta = 75°C
FREE AIR
n-ch
ACTIVE
n = 1
2
3
4
7
6
5

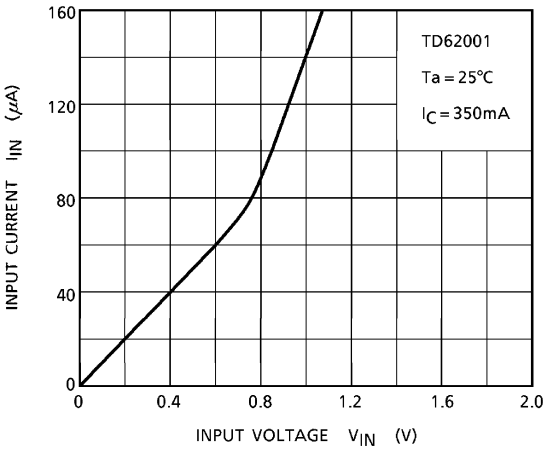

I_{OUT} – DUTY CYCLE
OUTPUT CURRENT I_{OUT} (mA)
DUTY CYCLE (%)
TD6200XF / AF
Ta = 25°C
On PCB
n-ch
ACTIVE
n = 1
2
3
4
7
6
5


I_{OUT} – DUTY CYCLE
OUTPUT CURRENT I_{OUT} (mA)
DUTY CYCLE (%)
TD6200XF / AF
Ta = 85°C
On PCB
n-ch
ACTIVE
n = 1
2
3
4
7
6
5

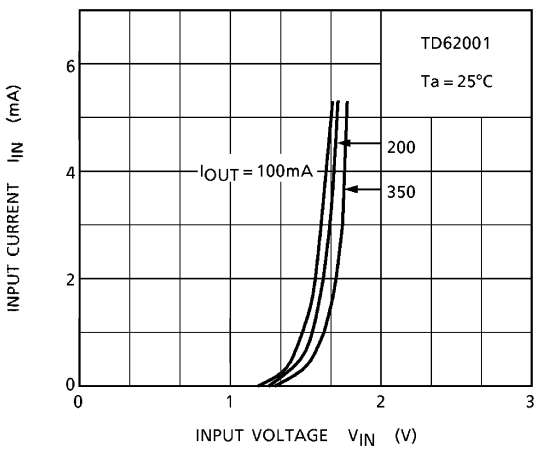

I_{OUT} – DUTY CYCLE
OUTPUT CURRENT I_{OUT} (mA)
DUTY CYCLE (%)
TD6200XAP
Ta = 25°C
FREE AIR
n-ch
ACTIVE
n = 1
2
3
4
5
7
6


I_{OUT} – DUTY CYCLE
OUTPUT CURRENT I_{OUT} (mA)
DUTY CYCLE (%)
TD6200XAP
Ta = 85°C
FREE AIR
n-ch
ACTIVE
n = 1
2
3
4
7
6
5

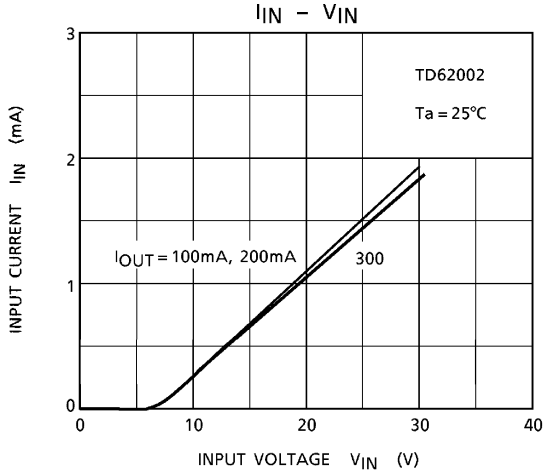
I_{IN} – V_{IN}



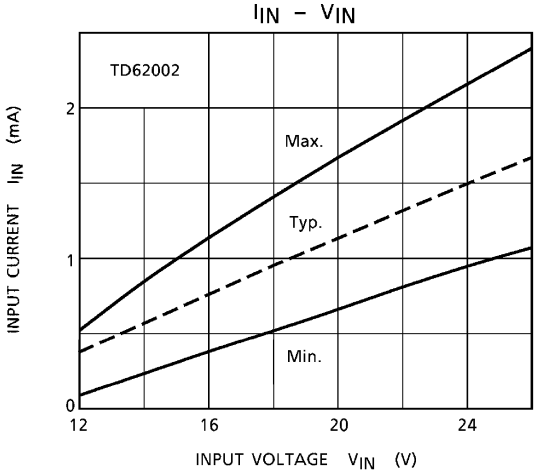
I_{IN} – V_{IN}



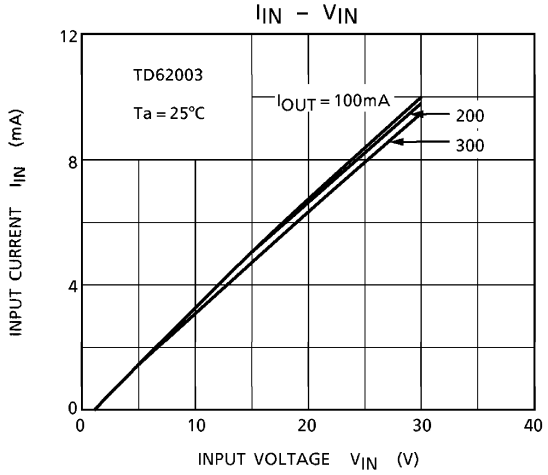
I_{IN} – V_{IN}



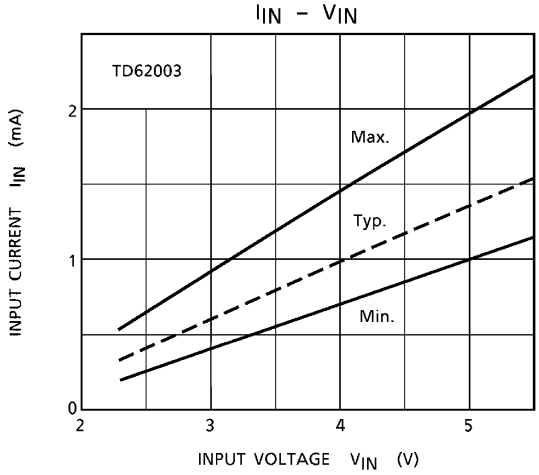
I_{IN} – V_{IN}



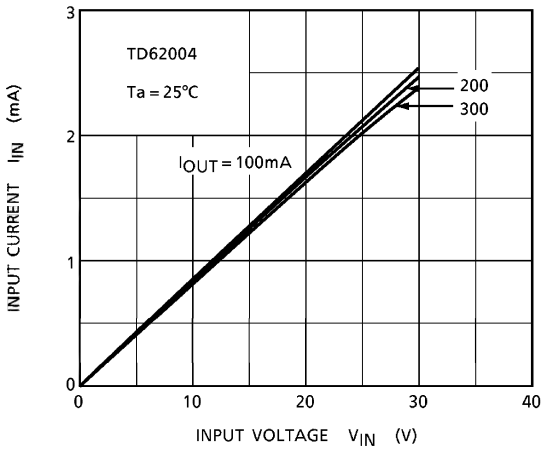
I_{IN} – V_{IN}



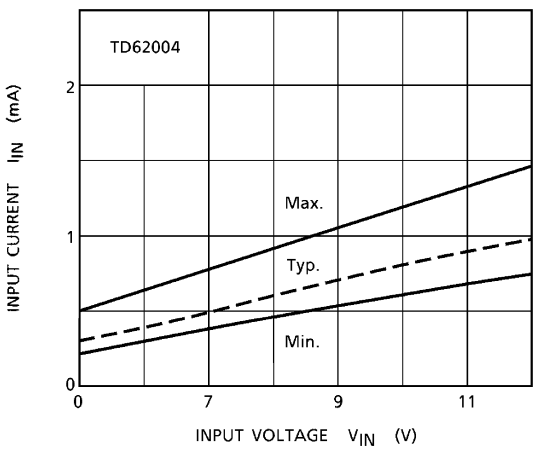
I_{IN} – V_{IN}



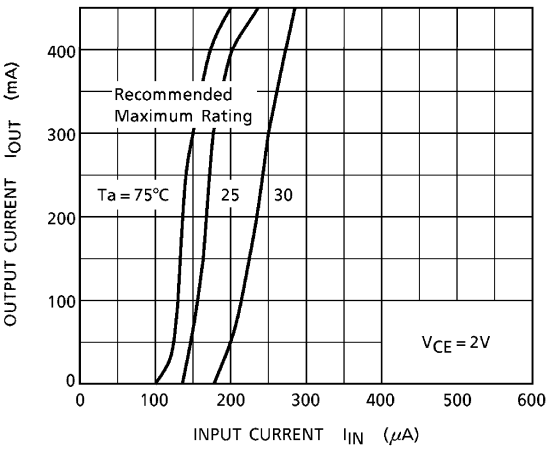
$I_N - V_{IN}$



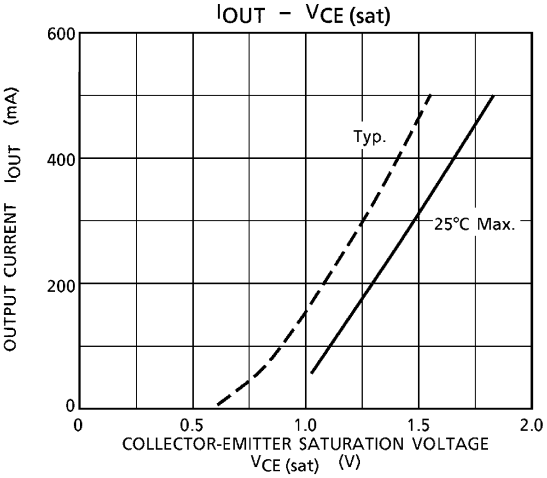
$I_N - V_{IN}$



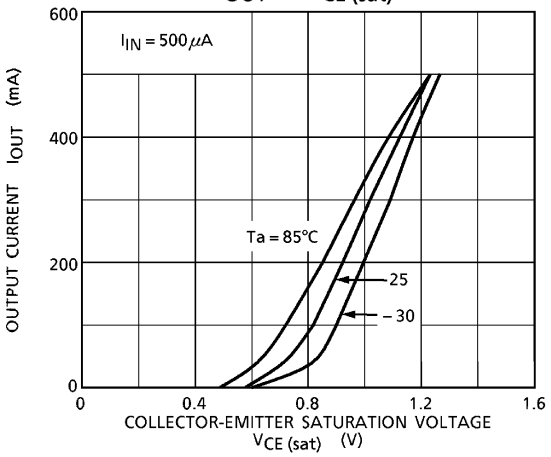
$I_{OUT} - I_{IN}$



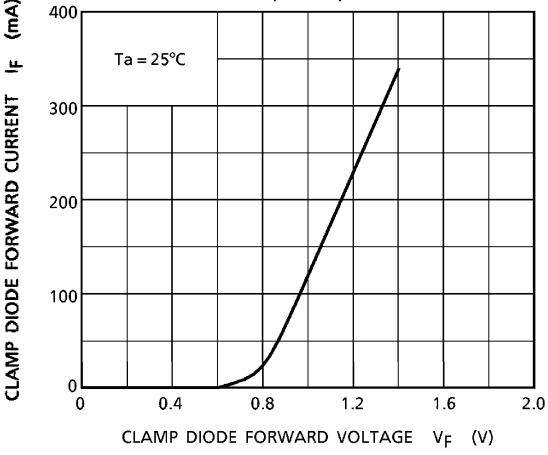
$I_{OUT} - V_{CE\,(sat)}$

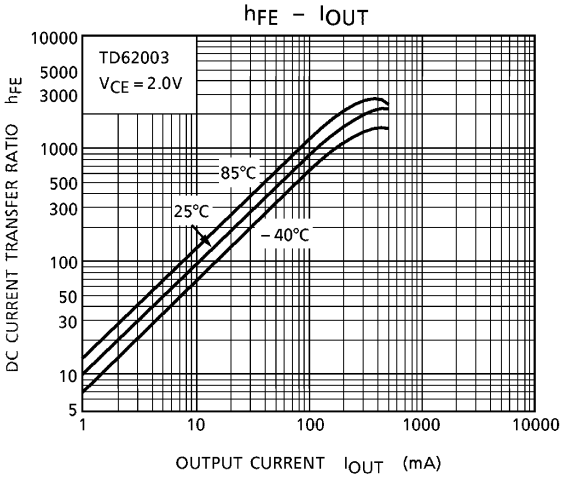


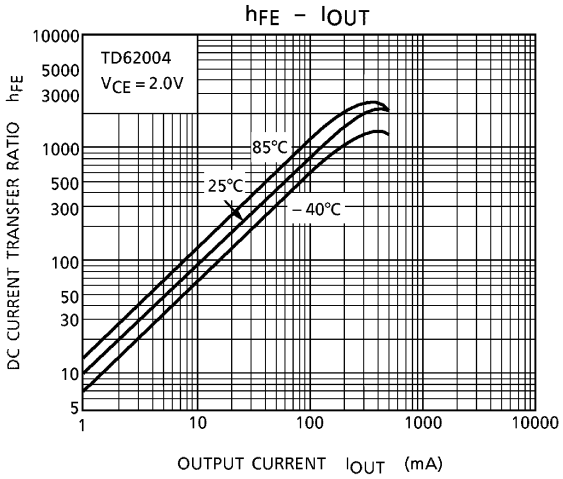
$I_{OUT} - V_{CE\,(sat)}$

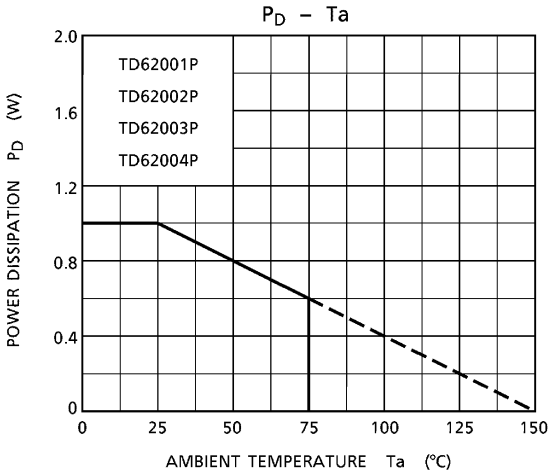


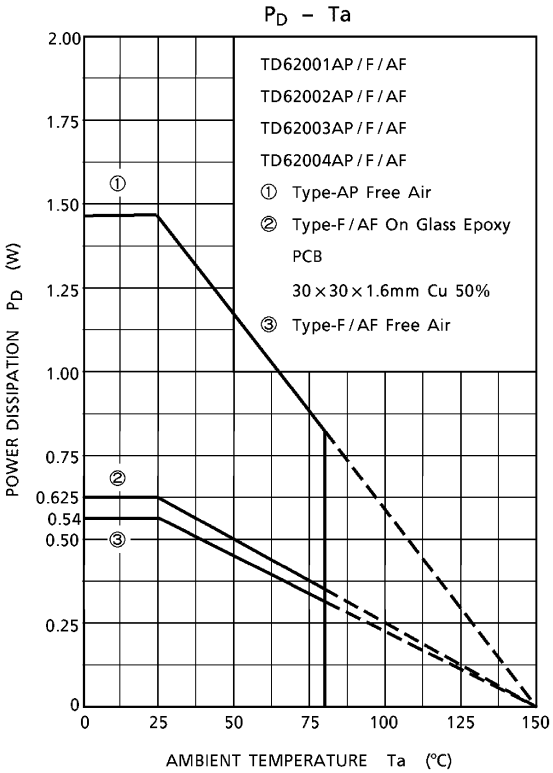
$I_F - V_F$




h_{FE} – I_{OUT}
TD62003
V_{CE} = 2.0V
85°C
25°C
– 40°C
DC CURRENT TRANSFER RATIO h_{FE}
OUTPUT CURRENT I_{OUT} (mA)
10000
5000
3000
1000
500
300
100
50
30
10
5
1
10
100
1000
10000


h_{FE} – I_{OUT}
TD62004
V_{CE} = 2.0V
85°C
25°C
– 40°C
DC CURRENT TRANSFER RATIO h_{FE}
OUTPUT CURRENT I_{OUT} (mA)
10000
5000
3000
1000
500
300
100
50
30
10
5
1
10
100
1000
10000

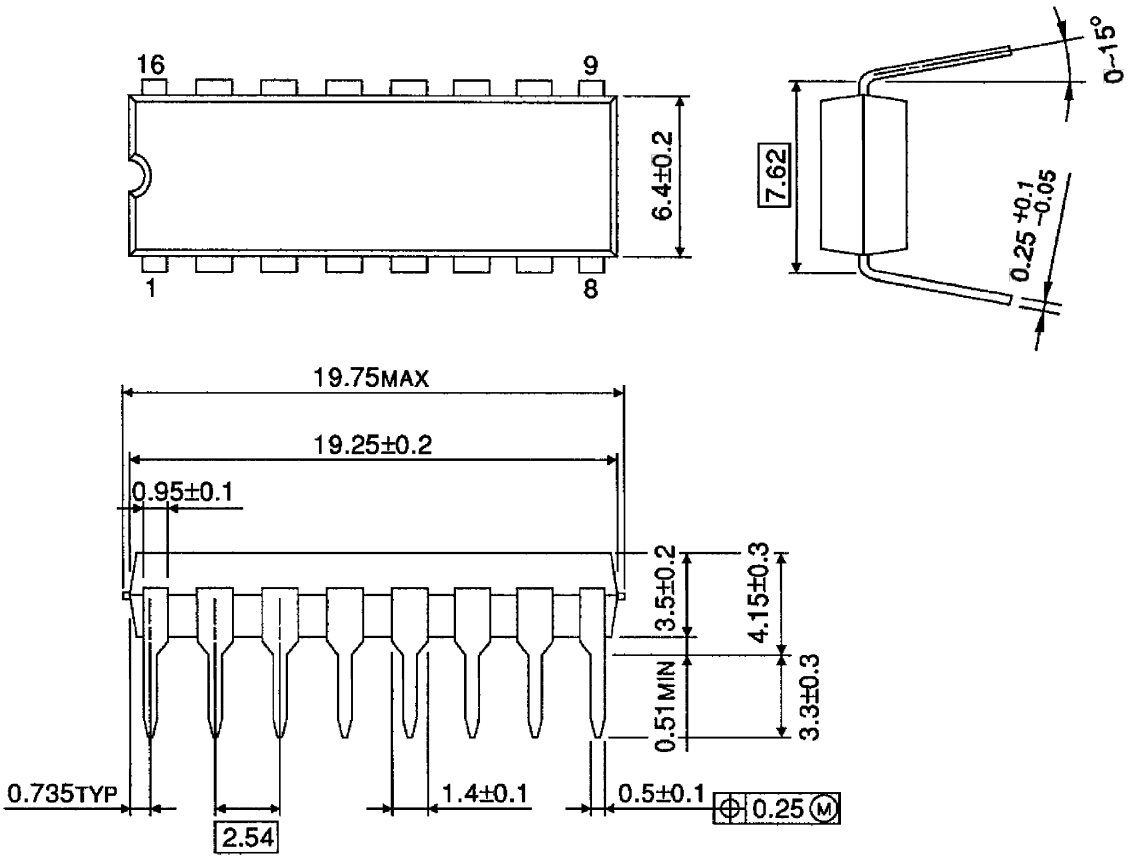

P_D – Ta
TD62001P
TD62002P
TD62003P
TD62004P
POWER DISSIPATION P_D (W)
AMBIENT TEMPERATURE Ta (°C)
2.0
1.6
1.2
0.8
0.4
0
0
25
50
75
100
125
150


P_D – Ta
TD62001AP / F / AF
TD62002AP / F / AF
TD62003AP / F / AF
TD62004AP / F / AF
① Type-AP Free Air
② Type-F / AF On Glass Epoxy PCB
30 × 30 × 1.6mm Cu 50%
③ Type-F / AF Free Air
POWER DISSIPATION P_D (W)
AMBIENT TEMPERATURE Ta (°C)
2.00
1.75
1.50
1.25
1.00
0.75
0.625
0.54
0.50
0.25
0
0
25
50
75
100
125
150

OUTLINE DRAWING

DIP16-P-300-2.54A

Unit : mm

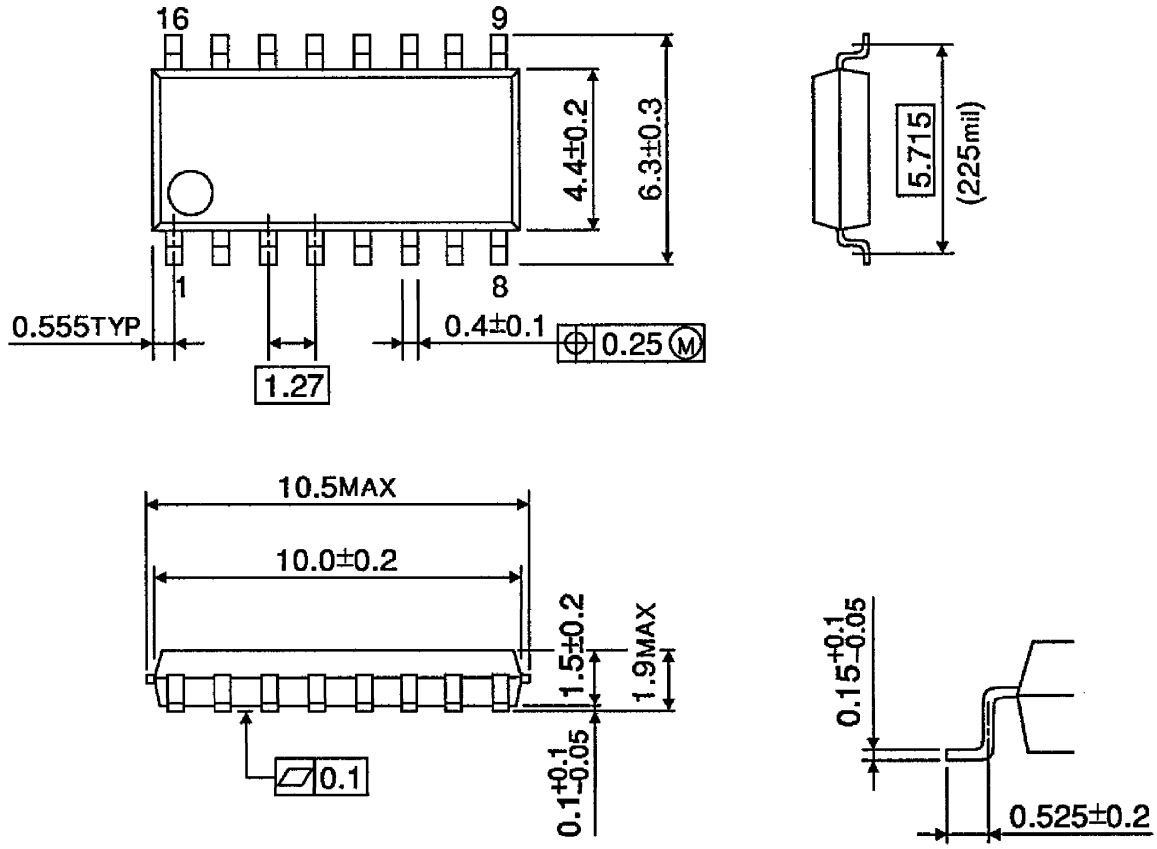


Weight : 1.11g (Typ.)

OUTLINE DRAWING

SOP16-P-225-1.27

Unit : mm



Weight : 0.16g (Typ.)